Water Efficient Installations – A New Army Guidance Document

Environment, Energy & Sustainability Symposium
Denver, CO
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Headquarters

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Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std Z39-18

What Are PWTBs?

- Introducing: Water Efficient Installations
- Public Works Technical Bulletins
- Sponsored by USACE HQ
- Variety of subjects
- Available through Whole Building Design Guide
- Accessible at:
- http://www.wbdg.org/ccb/browse_cat.php?o=31&c=215
- May have to use alternate path – CCB, Army/COE, then PWTB

PWTB Contents

- Overview
- Importance of water efficiency, water conservation
- Motivation
- Expand previous CERL Tech Report and FEMP BMP information
- Installation examples/experience
- Other
  - Water audit
  - Implementation of water loss program
- Water/energy interaction
- ESPC issues and concerns
- Resources

Water is Water!

- Essential to maintain life and quality of life
- The world is not producing any more
  - Limited amount of freshwater
  - Expanding needs: population, economy
- Vital to efficiently use and reuse and recycle what we have
- Current practices and supplies are not sufficient for future needs
- Only two options
  - Encourage less use
  - Find alternative sources and supplies
- Water is a valuable natural resource and commodity
  - Cost includes cost of water, wastewater treatment and disposal, energy for treatment, heating, and disposal and often pretreatment
- Conservation/efficiency versus new infrastructure
  - Demand side ($0 to 1.0 million/mgd
  - Supply-side Surface/ground, $1 - $3 million/mgd
  - Reuse, $1 – 5 million/mgd
  - Desalination, $3 – 10+

Costs for Water Conservation & Alternative Sources

Source: Amy Vickers & Associates, Inc., Amherst, MA

Increasing Military Demands

Sufficient high quality water is not only a global concern, but vital to the military in CONUS

Competition with other sectors

BRAC

Potential stopper in mission expansion

Concern in arid and semi-arid lands

Installation footprint may play major role in region

Water is essential for

- Industrial processes
- Military operations
- Installation quality of life

Military Installation Water Drivers

Water Resources

- Increasing Water Quantity and Quality Concerns
- Drought
- Climate Change

Legislative and Executive Drivers

- Clean Water Act
- Energy Policy Acts
- Executive Order 13514
- EISA Section 438

Defense/Army Strategies and Policies

- Strategic Plan for Army Sustainability
- Army Strategy for the Environment
- 2010 IMCOM Campaign Plan
- Installation Sustainability Plans - Water Conservation Goals
- LEED (Leadership in Energy and Environmental Design) USGBC
- Green Building Initiative
- Federal Best Management Practices

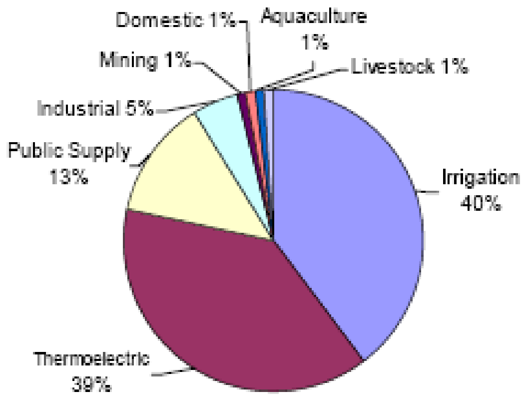
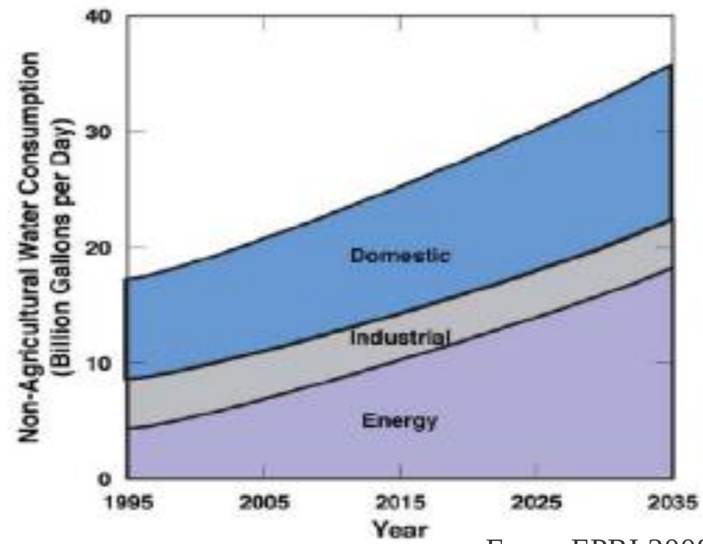
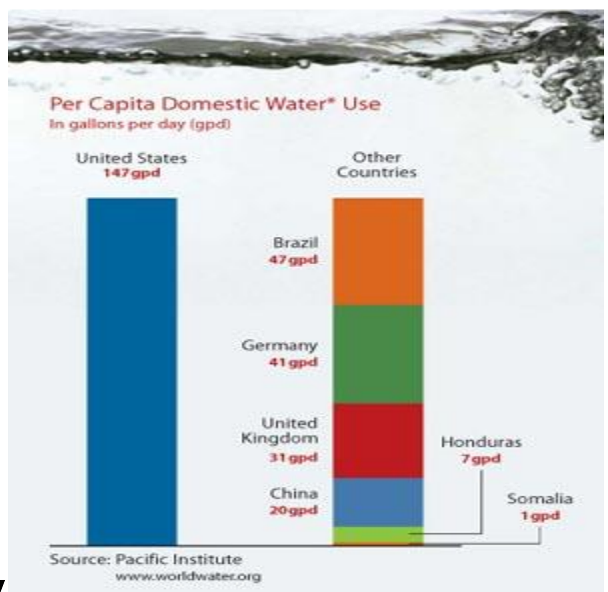


Figure 3-1
U.S. Freshwater Withdrawals in 2000

Source: USGS Circular 1268, *Estimated Use of Water in the United States in 2000*



From: EPRI 2008



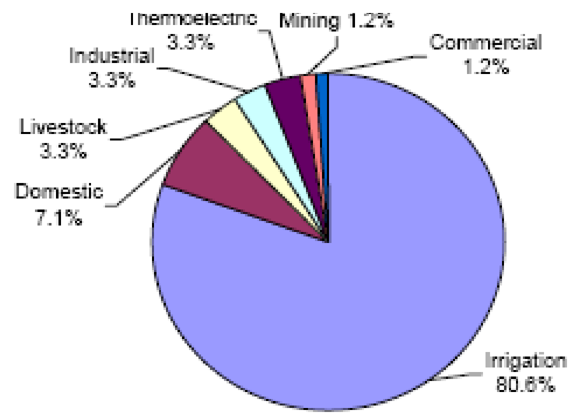


Figure 3-2
U.S. Freshwater Consumption in 1995

Source: U.S. DOE, *Energy Demands on Water Resources: Report to Congress* (2006)

FEMP Best Management Practices

1. Water Management Planning
2. Information and Education Programs
3. Distribution System Audits, Leak Detection and Repair
4. Water Efficient Landscaping
5. Water Efficient Irrigation
6. Toilets and Urinals
7. Faucets and Showerheads
8. Boiler/Steam Systems
9. Single-Pass Cooling Equipment
10. Cooling Tower Management
11. Commercial Kitchen Management
12. Laboratory/Medical equipment
13. Other Water Use
14. Alternate Water Sources

Definitions

- Water Efficiency – minimization of water used to accomplish a task
- Water Conservation – elimination or minimization of water loss, waste, or use
- Alternative Water Source – rainwater, stormwater, condensate, graywater, others
- Graywater – on-site treated or untreated effluent from lavatory or clothes washing, excludes blackwater
- Water Reuse – on-site water that is captured and reused
- Reclaimed Water (also called recycled or reuse) – municipal highly treated wastewater effluent
- Water efficiency and water conservation are usually considered interchangeable

Water Management Planning

- Water management plan overview
  - Water use policy statement and goals
  - Utility information
  - Water use information
  - Metering or measurement plan
  - Emergency response information
  - Comprehensive planning
  - Opportunity assessment
- Coordinate with facility environmental management systems

Information and Education Programs

- Essential if water efficiency technologies and methods are to be successful. New operation procedures, retrofits, and replacements are most effective when employees, contractors, residents, and the public know the new technology or methods are and how to use them properly.
- Positive public opinion
- Internal Information and Education Options
  - News media, user-friendly hotline, signage, suggestion and incentive programs, training workshops
- External Information and education Options
  - Work with local utilities and share successes, create displays, brochures, websites, work with local news media

Information and Education Programs

Distribution System Audits, Leak Detection and Repair

Program Benefits

- Reduce water losses
- Reduce operating costs
- Increased knowledge of the distribution system
- Reduce property damage
- Improved justification for water management
- Leak surveys – paybacks often in months
- Operation and Maintenance
  - Determine whether audit is needed, conduct audit

Retrofit and Replacement Options

- Fix leaks or replace pipes

Dripping faucet at 1.0 to 25 gal per hour can lose 8760 to 219,000 gal/year

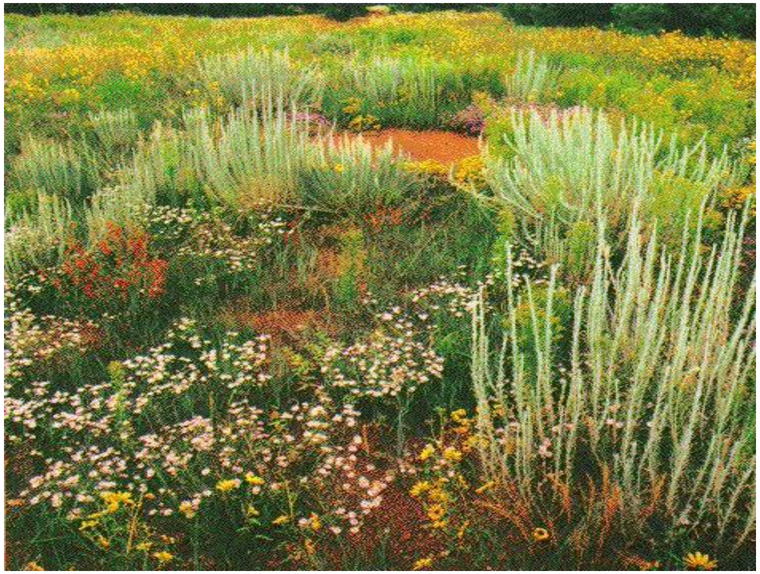
Broken flush valve on toilet can lose 40 gal/hour




Water Efficient Landscaping

- Design a landscape that requires minimal supplemental water.
- Design, install and maintain an irrigation system that applies appropriate amount of supplemental water in an efficient manner.

- Operation and Maintenance
  - Review service agreements
  - Hire knowledgeable landscape contractors – specialty water-efficient
  - Mulch
  - Recirculate water in water features
  - Proper mowing
  - Clean without water
- Retrofit and Replacement Options
  - Design for water efficiency
- Reduce or avoid turf
  - Drought-tolerant plantings – climate-appropriate, native vegetation
  - Implement LID techniques
  - Hydrozoning
  - Proper planting technique



Water Efficient Irrigation

Proper training in system installation, maintenance and management

WaterSense Irrigation partner

Review service agreements to incorporate high priority for water efficiency

Immediate reporting and repair of problems

Irrigation system audit every three years

Irrigation meter

Proper scheduling of water application

Shutoff nozzles on handheld hoses

Consider weather-based irrigation controls

Soil-moisture-based irrigation controls

Central systems with demand-based controls

Micro or drip irrigation where appropriate

Proper sprinkler heads and placement

Rain-sensing technology

Freeze-sensing technology

Flow rate monitoring equipment

Water Efficient Landscaping and Irrigation

Options for the Reduction of Outdoor Garden/Landscape Water Use

Management Options	Potential Savings (Percent)
Turf maintenance	10
Turf maintenance, irrigation system	20
Maintenance, Irrigation Scheduling	
Mulching in Ornamental Gardens	20
Soil Amendments (Compost)	20
Irrigation Scheduling	25
Irrigation/Soil maintenance	65 to 75
Lawn to go Dormant	90
Hardware Options	
Auto rain Shut Off	10
Soil Moisture Sensors; Soil Probes	10 to 30
Improve Performance	40
Drip/Bubbler Irrigation	50
Gray Water	Up to 100
Rain Barrel Catchment	Up to 100
Landscape Design Options	
Landscape Design	19 to 55
Turf Reduction	19 to 35
Choice of Plants	30 to 80

From Gleick et al.

Toilets and Urinals

ULFTs Ultra-Low Flush Toilet, also called low flow 1.28 gpf to 1.6 gpf
HETs High Efficiency Toilets 1.28 gpf or less, 50 manuf., 500+ models
Required in CA
Dual flush options also available

WaterSense program provides certification and specifications

Urinals
National standard is 1.0 gpf
High efficiency urinals: 0.5 gpf to one pint per flush

Non-water urinals, waterless urinals
Hundreds of thousands in use
Army standard, proper maintenance essential
Some plumbers recommend flushing unit at top of drainline

Toilets

Faucets and Showerheads

Federal standard 2.2 gpm or less

EPA's WaterSense program residential lavatory 1.5 gpm or less

Public use –ASME max of 0.5 gpm

Showerhead Federal standard 2.5 gpm

Showerheads WaterSense spec. 2.0 gpm max

O&M
Fix leaks
Proper pressure in system 20 to 80 psi
Reduce water heater settings
Avoid retrofitting with flow control inserts or valves

Boiler/Steam Systems

- O&M
  - Routine inspection, repair leaks quickly
  - Annual tuneups
  - Insulation
  - Proper blowdown control
  - Expansion tank to temper blowdown drainage rather than cold water mixing
  - Meters on makeup lines
- Retrofit
  - Install a condensate return system
  - Automatic blowdown system
  - Automatic chemical feed system
  - Monitoring
  - Blowdown heat exchangers in large systems
- Replacement
  - Energy audit to reduce heating load
  - Purchase life-cycle-cost-effective boilers
  - Consider small summer boiler, distributed system or heat-capture system for reheat or dehumidification
  - Consider alternative technologies such as heat pumps

Single-Pass Cooling Equipment

Opportunity for significant water savings.

Typical equipment: CAT scanners, degreasers, hydraulic equipment, condensers, air compressors, welding machines, vacuum pumps, ice machines, X-ray equipment and air conditioners.

Use 40 times more water than a cooling tower operated at five cycles of concentration.

Recommendation: Modify to recirculate or eliminate

Add automatic control to shut off during unused hours if fe4asible.

Use effluent, if feasible, for boiler makeup or irrigation

Cooling Tower Management

Water leaves a cooling tower from: evaporation, drift, blowdown and basin leaks or overflows

The sum of water that is lost must be replaced by make-up water

Make-up = Evaporation + Blowdown + Drift

Cycles of concentration important consideration, want to maximize but dependent on water chemistry

Consider other water sources: air handler condensate, water from once through cooling systems, high quality effluent or recycled water

Work with experts

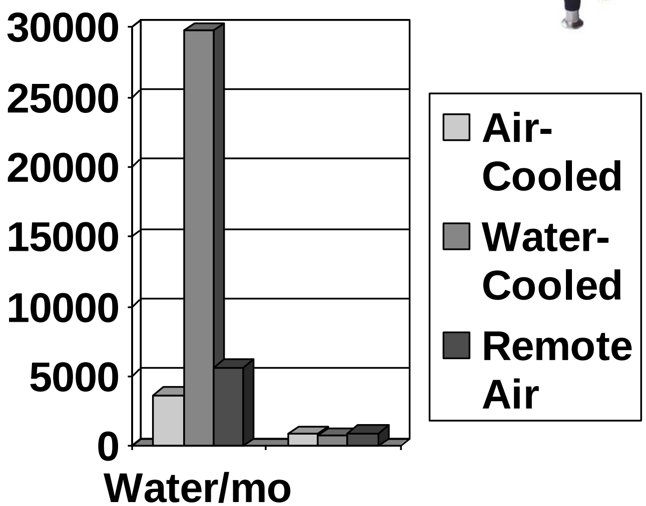
Commercial Kitchen Management

- Staff education
- Only run dishwashers when full
- Check water temperatures and flow rates to match manufacturer recommendations
- Test system pressure
- Use batch loading for steam cooking
- Eliminate or minimize use of garbage disposals by using strainers or traps

- Modify ice machines to use closed loops or use air-cooled unit
  - Capture and reuse cooling water from old units
  - New machines use can use 10 percent of water cooled units
- Purchase ENERGY STAR brand dishwashers and food service equipment
- Use high efficiency spray valves (save thousands with a $75 item)
- Manufacturers have water conserving features in their equipment
- Savings in annual and lifetime costs in both water and energy

Commercial Kitchen Management

Pre-rinse spray valves
SOMAT system
Boilerless food steamers
Air-cooled icemakers
Water conserving dishwashers
Eliminate garbage disposals
Eliminate steam tables
Steam kettles
Adequate refrigeration
Waterless wok

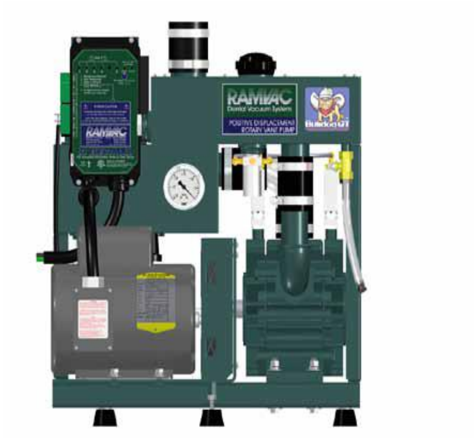

30000
25000
20000
15000
10000
5000
0
Water/mo
Air-Cooled
Water-Cooled
Remote Air

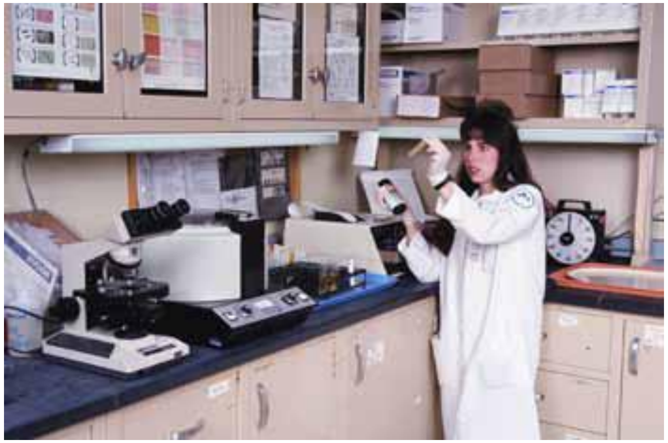
SOMAT System
Pulper and Hydra-Extractor

Laboratory/Medical Equipment

- Be aware of Labs 21 program from USEPA and DOE
- Shut off units not in use
- Install pressure reducing device on equipment that does not require high pressure
- Set flow rates near minimums
- Use efficient disinfection/sterilization equipment
- Use small expansion tank instead of using water to cool steam for sewer discharge
- Consider uncontaminated, non-contact steam condensate and cooling water as make-up for non-potable uses
- Replace older equipment with digital x-ray and photographic equipment and computerized printing
- Use a laboratory vacuum system instead of faucet-based aspirators
- Use newer water-efficient glassware washers
- In animal facilities, use counter current washers
- Reuse unusable drinking water for cleaning or cooling towers

Laboratory/Medical Equipment





Other Water Use

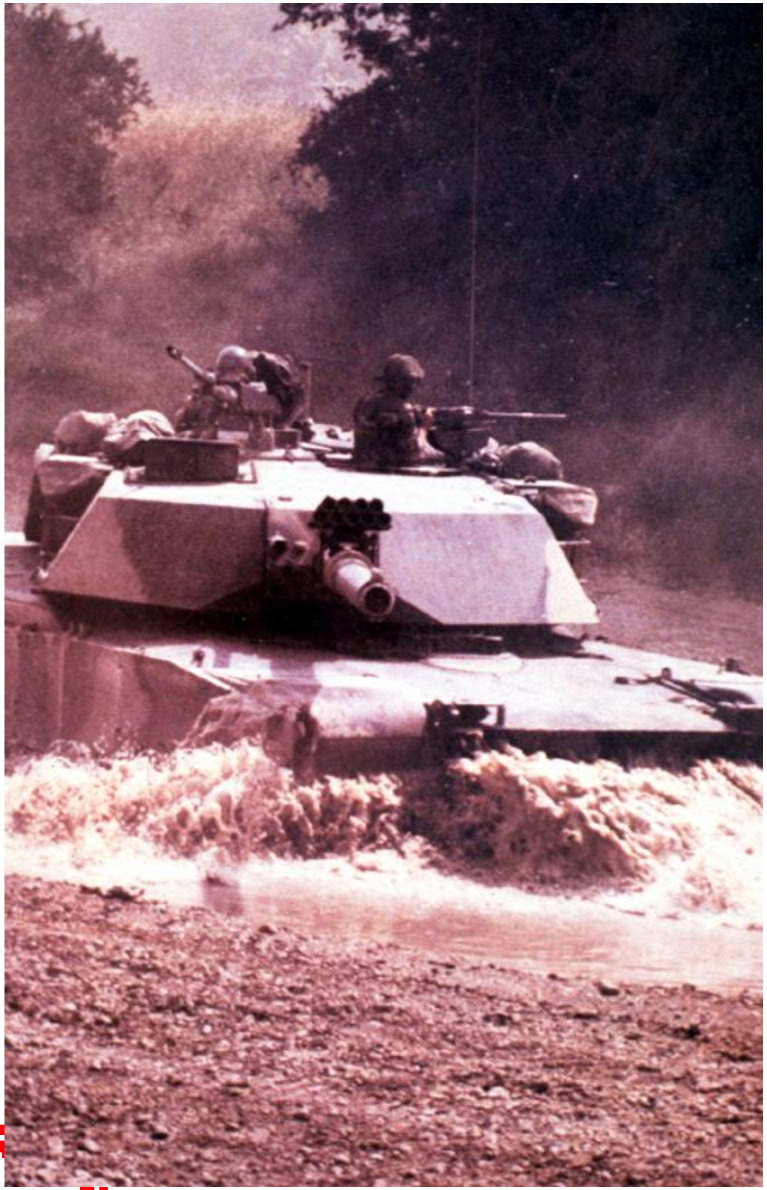
- Laundries
  - Wash full loads
  - Replace old washers with more efficient models, tunnel washers
  - tunnel washer units can have 60% energy recovery and paybacks of 1-5 years
- Households can get efficient units such as horizontal axis machines

- Evaporative cooling
  - Keep tight rein on bleed-off

- Vehicle washing
  - Aircraft
  - Automotive vehicle washrack
  - Tracked vehicle washrack

- Wastewater recycling in washracks

- New technology



Central Vehicle Wash Facility

US Army Corps
of Engineers®

Other Water Use/Alternate Water Sources Options

- Water reuse
- Desalination
- Produced water
- Rainwater harvesting
- Graywater reuse
- Sewer mining
- Stormwater runoff
- Air conditioning condensate
- Municipal supplied reclaimed water

Water Reuse

~90% of water needs do not require potable quality

Why?

- Overcome water scarcity
- Environmental protection requirements
- Drought
- Increasing demands
- Dependable supply

Benefits

- Drought-proof
- Quantity increases with growth
- Reduce stress on aquifers and surface waters
- Improved water security
- Local control

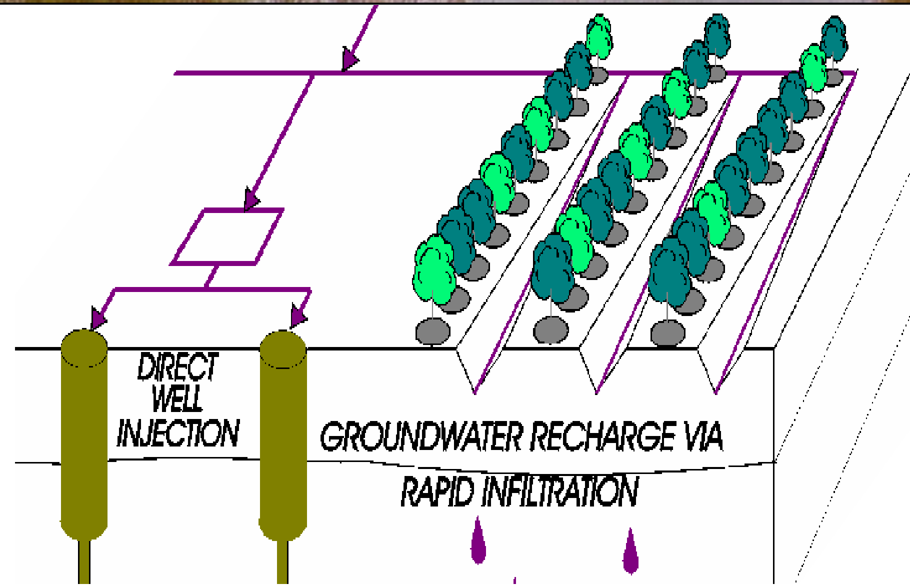
Trends

- Gaining in prominence around the globe
- On Federal radar screen
- Indirect potable reuse here

Water Reuse Categories & Typical Applications

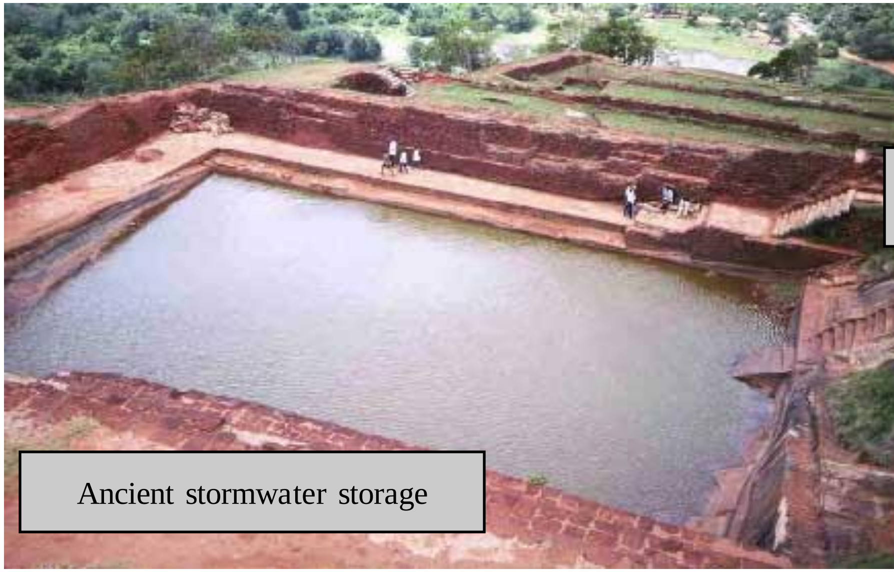
Category	Typical Application
Irrigation	Parks School yards Highway medians Golf courses Cemeteries Parade grounds Athletic fields Building landscapes Crops or vegetable gardens
Industrial recycling and reuse	Cooling water Boiler feed Process water Construction
Groundwater recharge	Groundwater recharge Saltwater intrusion control Subsidence control
Recreational/environmental uses	Lakes and ponds Marsh enhancement Streamflow augmentation Fisheries
Nonpotable urban uses	Fire protection Air conditioning Toilet flushing Water features

Reuse Opportunities

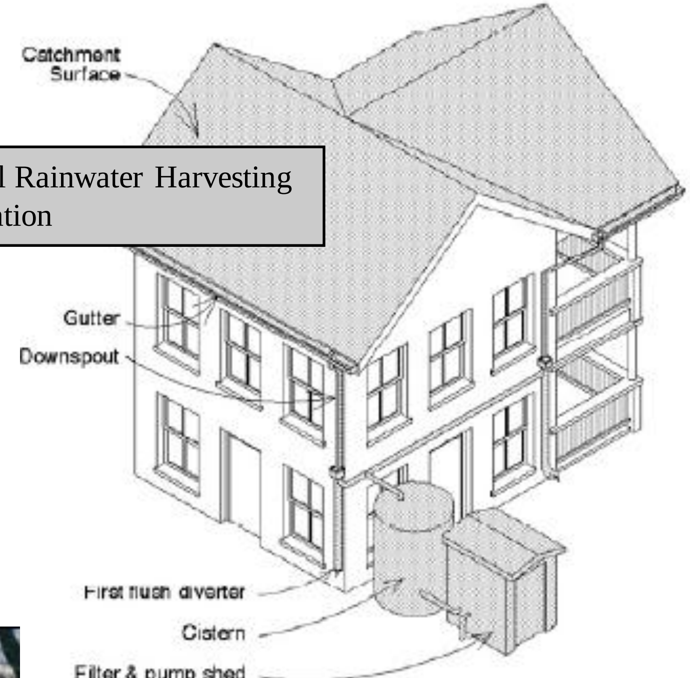


Using Rainwater

- Advantages
  - Saves water
  - Less discharge
  - Less energy and chemical use
  - Reduction of hydraulic load to existing systems
- Disadvantages
  - May be more costly
  - May decrease flow to wastewater plant



Ancient stormwater storage



Typical Rainwater Harvesting Installation

Rainwater Storage

RWH Systems for Livestock and Wildlife

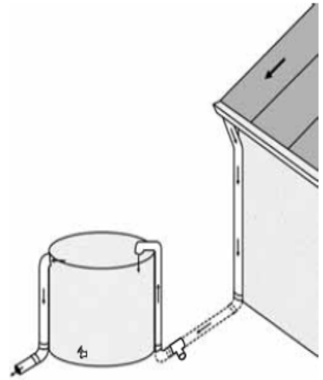


Figure 1. A typical rainwater harvesting system uses a roof, gutters, downspout and pipes underground, and backup into the top of the collection tank. This prevents livestock from damaging the pipes and allows the tank to be much further away from the shed. Unless there is a drain along the lower pipe, the standing pipes will contain water that is susceptible to freezing.

From: Texas Cooperative Extension TAMU

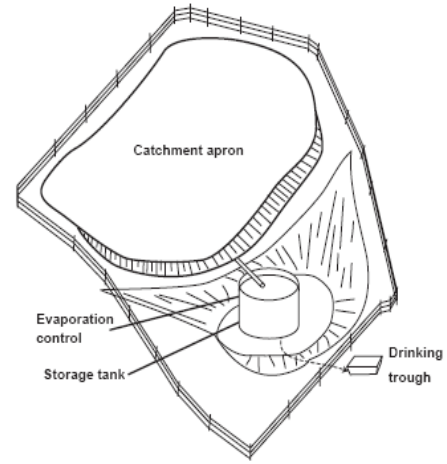


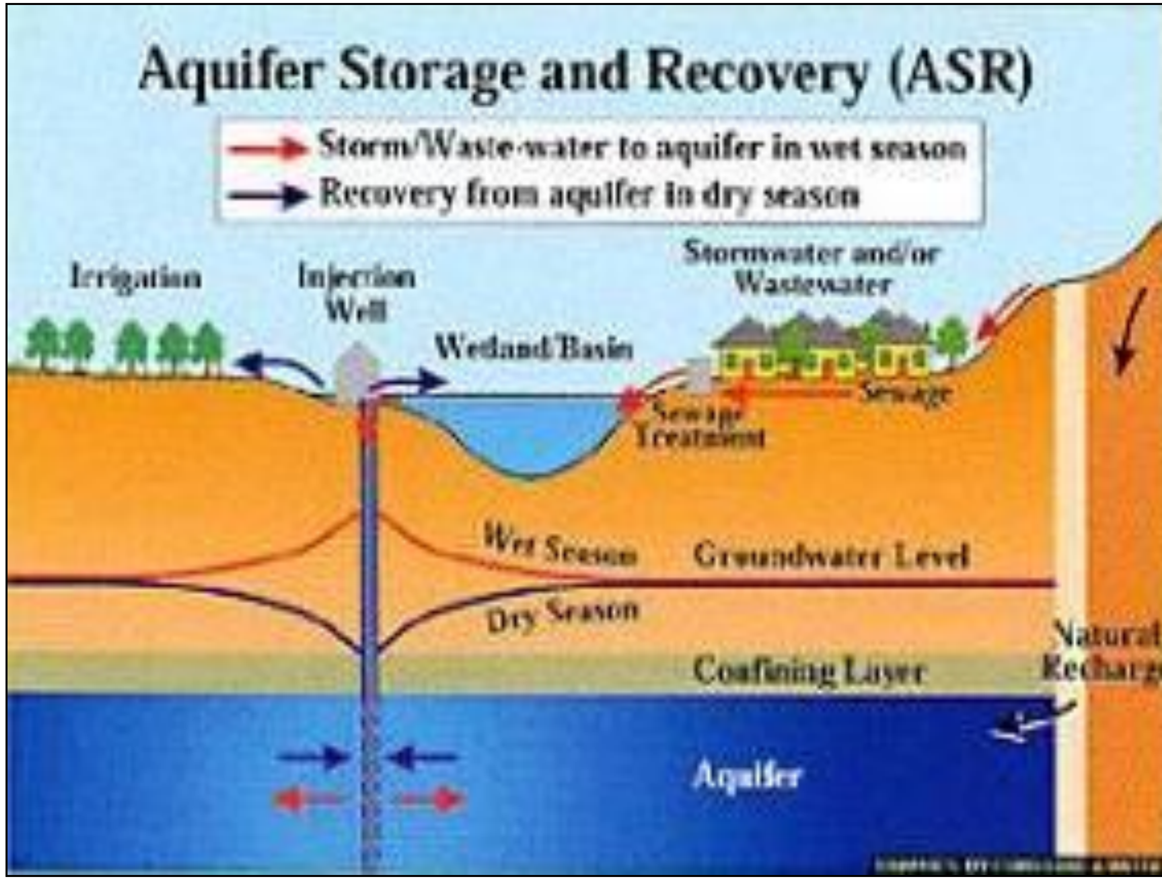
Figure 2. This rainwater harvesting system uses a prepared surface of concrete, rock or a sealing material to shed the rainfall. The rainwater is then diverted into the top of the collection tank



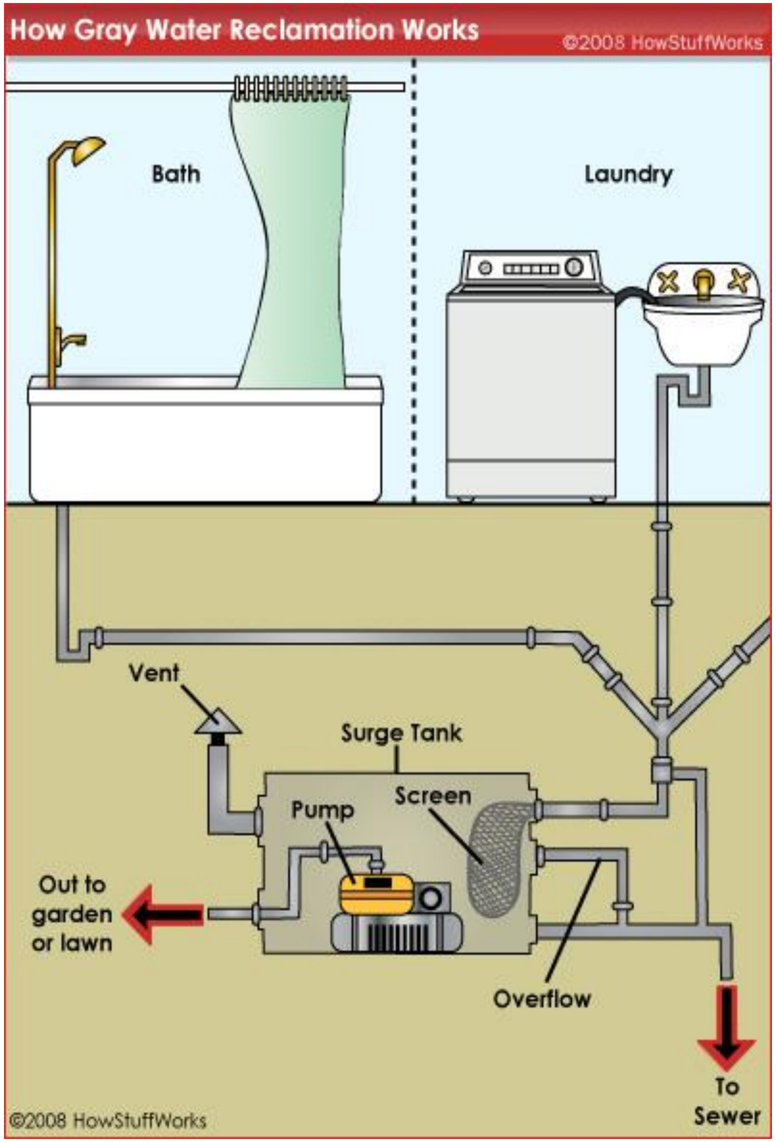


Aquifer Storage and Recovery

During a high rainfall period, excess stormwater is filtered and cleaned and then pumped into the aquifer. The water can be recovered and used for irrigation or other purposes.



Graywater Treatment



Where to Make an Impact

Irrigation – Large Water Consumer

- parade grounds
- parks and recreation areas
- athletic fields
- golf courses
- cemeteries
- landscaped grounds

Buildings

- institutional
- industrial
- barracks

Fort Huachuca Examples


WELCOME


Rainwater Harvesting

- Ideal for large barracks, industrial or commercial/institutional buildings

- Also applicable to expansive parking lots

- Water stored in tanks or ponds – reducing runoff
- Stored water can be used indoors – filtered and treated – fixture flushing, laundry, cooling tower, boiler makeup
- Outdoors – irrigation, water features
- Result – reduces overall demand for municipal water

Resources

Many Websites and organizations such as

Alliance for Water Efficiency

American Refrigeration Institute

American Water Works Association

California Urban Water Conservation Council

Consortium for Energy Efficiency

East Bay Municipal Utility District

Federal Energy Management Program

Food Technology Service Center

USACE –ERDC – CERL

USEPA WaterSense Program

Whole Building Design Guide

Individual States

Contact Author for additional sources

Summary

- Water is an essential resource vital to maintain quality of life and support mission
- Military demands only one of many sectors needing water
- Numerous drivers promote water efficiency
- Water has become increasingly in demand
- Current practices and supplies are insufficient for the future.
- Must use less or find new sources or supplies
- Variety of options exist for water efficiency
- New/emerging technologies should be demonstrated/adopted
- Match water quality with needs

Questions, Comments?

Contact information or for additional information or resources

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217-398-5590

Low Impact Development (LID)

Energy Independence and Security Act of 2007

PUBLIC WORKS TECHNICAL BULLETIN 200-1-36
30 SEPTEMBER 2005

SUSTAINABLE STORMWATER STORAGE ALTERNATIVES FOR ARMY INSTALLATIONS

Find at:
http://www.wbdg.org/index.php

- **Describes basic LID practices**
- **Many graphics showing techniques**
- **Relates to SPiRiT guidance, but LEED® adaptable**

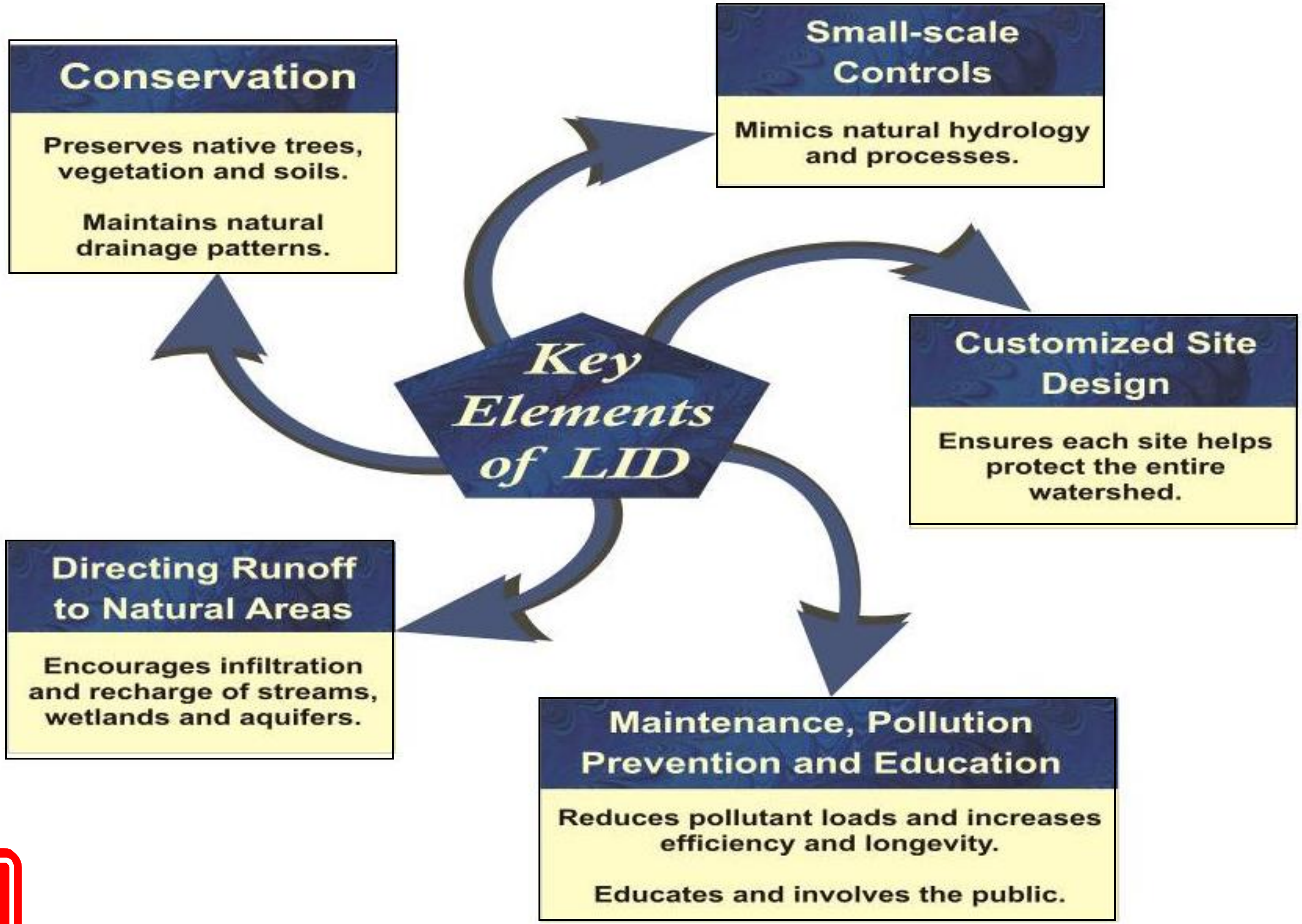
SEC. 438

STORM WATER RUNOFF REQUIREMENTS FOR FEDERAL DEVELOPMENT PROJECTS

"The sponsor of any development or redevelopment project involving a Federal facility with a footprint that exceeds 5,000 square feet shall use site planning, design, construction, and maintenance strategies for the property to maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology of the property with regard to the temperature, rate, volume, and duration of flow."

Low Impact Development (LID)

principals in a nutshell



LID Examples